MM400A

DIGITAL HYBRID WIRELESS™
MINIATURE UHF BELT-PACK TRANSMITTER

OPERATING INSTRUCTIONS

LECTROSONICS, INC.

Rio Rancho, NM
www.lectrosonics.com

The MM400 transmitter is FCC type accepted under Part 74: 536-608 MHz and 614-806 MHz

Thank you for selecting the Lectrosonics MM400A miniature transmitter. The unique design provides several distinct features for professional applications:

- Outstanding RF operating range
- Superb audio quality
- Ultra-lightweght, corrosion resistant housing
- Watertight seals for use in wet environments
- Programmble emulation modes for maximum versatility

The Digital Hybrid Wireless™ design (US Patent Pending) combines 24-bit digital audio with analog FM techniques to provide the operating range of the finest analog wireless systems and the audio quality of a pure digital system. The 100 mW RF output power extends operating range, and DSP controlled, dual-envelope limiter cleanly handles input peaks to allow higher gain settings. This combination maximizes operating range and the signal to noise ratio of the system.

The input provides 6 VDC of bias voltage for use with modern electret lavalier microphones. Multi-color LEDs are provided on the control panel to make input gain adjustments quick and accurate, without having to view the receiver. The battery compartment accepts AA alkaline, lithium or NiMH batteries. The antenna is a detachable, locking ¼ wavelength flexible bronze cable that connects to a 50 Ohm SMA port on the transmitter.

The MM400A is machined from a solid aluminum block to provide an extremely ightweight package with the ruggedness needed in extreme environments. Input jacks and controls are O-ring sealed for watertight protection in wet environments. A special non-corrosive finish (same as is used on NASA space vehicles) resists salt water exposure and perspiration in extreme environments.

The DSP-based design offers backward compatibility with a handful of earlier analog designs, such as the Lectrosonics 100 and 200 Series receivers, and some other brands of analog wireless receivers. The operating mode (compatibility mode) can be selected with a sequence of frequency switch settings and battery insertions to cycle the power on and off. Only the MM400A transmitter is covered in this manual. Companion receivers are covered in separate manuals.

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GENERAL TECHNICAL DESCRIPTION

GENERAL

The 400 system uses 75 kHz wide deviation for an extremely high signal to noise ratio. The switching power supplies provide constant voltages to the transmitter circuits from the beginning (1.5 Volts) to the end (0.85 Volts) of battery life. The input amplifier uses an ultra low noise op amp for quiet operation. It is gain controlled with a wide range dual envelope input compressor which cleanly limits input signal peaks over 30 dB above full modulation.

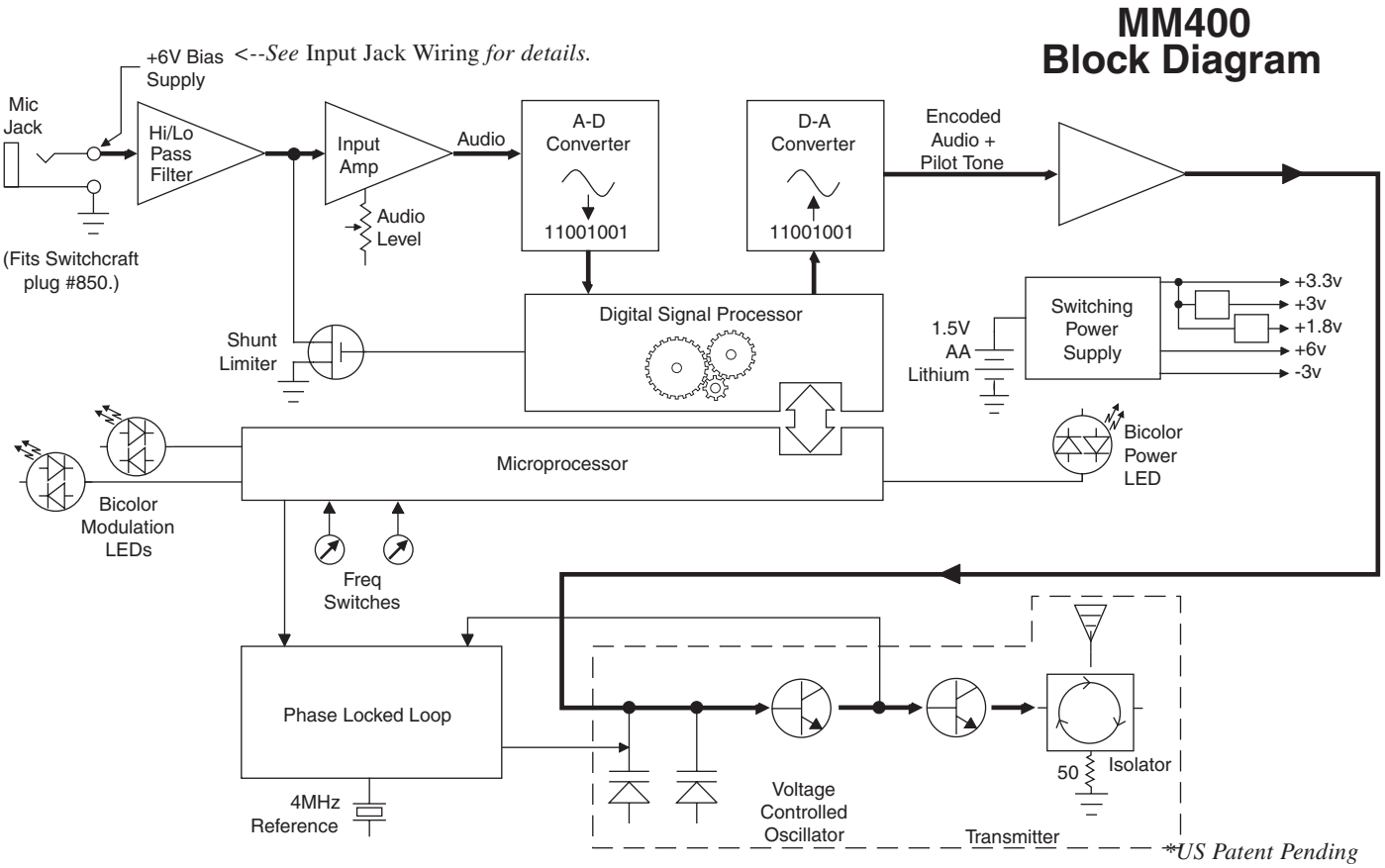
DIGITAL HYBRID WIRELESS ™ TECHNOLOGY*

All wireless links suffer from channel noise to some degree, and all wireless microphone systems seek to minimize the impact of that noise on the desired signal. Conventional analog systems use compandors for enhanced dynamic range, at the cost of subtle artifacts (known as “pumping” and “breathing”). Wholly digital systems defeat the noise by sending the audio information in digital form, at the cost of some combination of power, bandwidth and resistance to interference.

The Lectrosonics Digital Hybrid system overcomes channel noise in a dramatically new way, digitally encoding the audio in the transmitter and decoding it in the receiver, yet still sending the encoded information via an analog FM wireless link. This proprietary algorithm is not a digital implementation of an analog compandor but a technique which can be accomplished only in the digital domain, even though the inputs and outputs are analog signals.

Channel noise still has an impact on received signal quality and will eventually overwhelm the receiver. The Digital Hybrid simply encodes the signal to use a noisy channel as efficiently and robustly as possible, yielding audio performance that rivals that of wholly digital systems, without the power and bandwidth problems inherent in digital transmission. As always, these advantages come at a cost. The Digital Hybrid system requires fairly intensive digital processing in both the transmitter and the receiver. These processors cost money, take up space and consume power. The Digital Hybrid system also requires that the underlying RF link be of excellent quality, with better frequency response and distortion characteristics than that required by conventional systems.

Because it uses an analog FM link, the Digital Hybrid enjoys all the benefits of conventional FM wireless systems, such as excellent range, efficient use of RF spectrum, and resistance to interference. However, unlike conventional FM systems, the Digital Hybrid has done away with the analog compandor and its artifacts.



NO PRE-EMPHASIS/DE-EMPHASIS

The signal to noise ratio of the 400 system is high enough to preclude the need for conventional pre-emphasis (HF boost) in the transmitter and de-emphasis (HF roll off) in the receiver. Pre-emphasis and de-emphasis in an FM radio system usually provides about a 10 dB improvement in the signal to noise ratio of the system, but the high frequency boost in the transmitter must be removed in a purely complementary manner or else the frequency response of the original audio signal will be altered.

Pre-emphasis can also cause distortion in the receiver. As the pre-emphasized signal is passed through the IF filters in the receiver, distortion can be produced, most noticeable at full modulation. De-emphasis cannot be applied until the signal is converted into audio, so there is no way around this problem short of eliminating pre-emphasis altogether. Neither of these problems occur in the 400 system.

LOW FREQUENCY ROLL-OFF

A 12 dB per octave low frequency roll-off is provided in the audio section, with the -3 dB point at 70 Hz. The actual roll-off frequency will vary somewhat according to the low frequency response of the mic capsule being used.

The low frequency roll-off is used to remove subsonic (or very low frequency) audio, often produced by air conditioning systems, automobile traffic and other sources from the audio signal. Excessive low frequency content in the audio input can cause a variety of audio problems including driving the transmitter into limiting. In sound reinforcement systems, as one instance, excessive low frequency content can cause excessive power amplifier drain or even damage to loudspeaker systems.

INPUT LIMITER

The 500 series transmitters employ a digitally-controlled analog audio limiter just before the analog-to-digital converter. The limiter has a range of more than 30 dB for excellent overload protection. A dual release envelope makes the limiter acoustically transparent while maintaining low distortion. It can be thought of as two limiters in series, connected as a fast attack and release limiter followed by a slow attack and release limiter. The limiter recovers quickly from brief transients, so that its action is hidden from the listener, but recovers slowly from sustained high levels, to both keep audio distortion low and preserve short term dynamic changes.

The audio level LEDs indicate limiter activity. The first red LED indicates that the limiter is active and that the transmitter is fully modulated (audio level is between +0 and +10 dB). The second red LED indicates that the level is 10 dB or more into limiting. Occasional forays into the red are desirable for most applications, since the distortion introduced by the limiter is so minimal, and full modulation is thus assured. We strongly recommend setting the gain of the transmitter high enough so that the first red LED occasionally lights.

Generally speaking, some limiting is desirable in normal operation to improve the signal to noise ratio of the system. The limiting action is not audible and does not create distortion. A highly trained ear would hear only the compression of the peaks in the audio signal, which is desirable with most recorders and many sound reinforcement systems.

PILOT TONE SQUELCH

The 400 Series wireless system utilizes an ultrasonic tone between 25 and 32 kHz to operate the receiver squelch. The pilot tone squelch system keeps the receiver muted until it receives the pilot tone from the matching transmitter, even if a strong RF signal is present on the carrier frequency of the system. The “pilot tone” frequency is different for each of the 256 available carrier frequencies to prevent the pilot tone from being transferred to the wrong receiver via an intermodulation product.

WIDE-BAND DEVIATION

A ±75 kHz deviation improves the capture ratio, signal to noise ratio and AM rejection of a wireless system dramatically, compared to other designs that use 30 kHz to 40 kHz deviation. This combined with a full 100 mW of power output makes a significant improvement in signal to noise ratio and maximum operating range.

BATTERY LIFE

Switching power supplies throughout the design allow about 4.5 hours of operation using a single AA lithium battery. (an alkaline AA battery will provide about 2 hours - a NiMH AA battery will provide about 3.5 hours) The battery contacts are spring loaded to prevent “rattle” as the unit is handled.

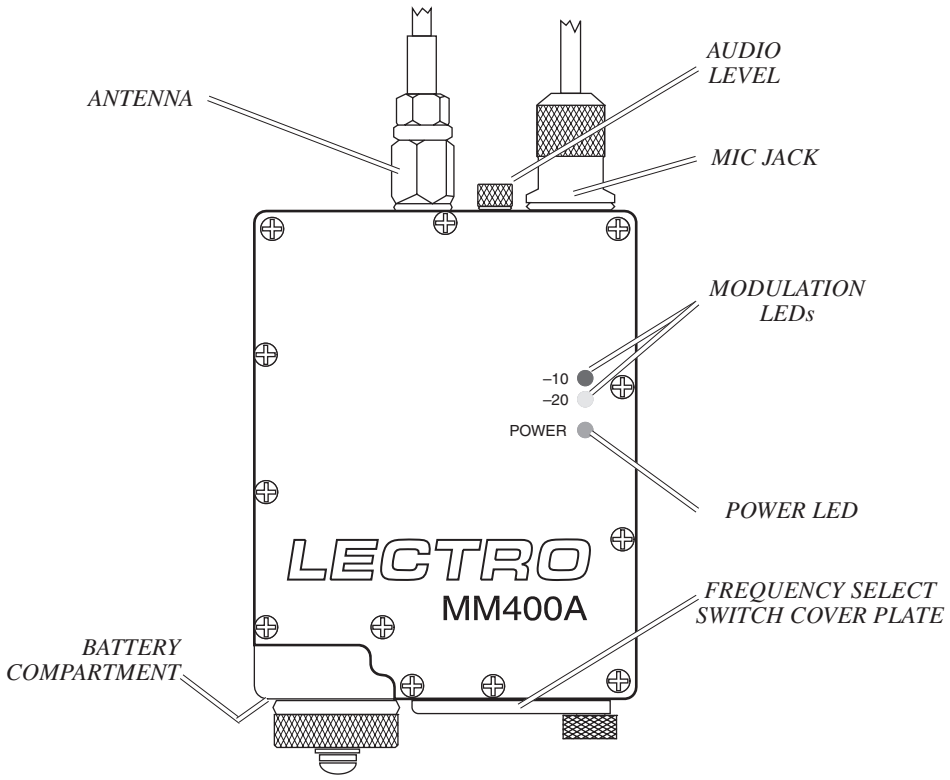
FREQUENCY AGILITY

The transmitter section uses a synthesized, frequency selectable main oscillator. The frequency is extremely stable over a wide temperature range and over time. Two rotary switches, located on the side panel of the unit, provide 256 frequencies in 100 kHz steps over a 25.5 MHz range. This alleviates carrier interference problems in mobile or traveling applications.

CIRCULATOR/ISOLATOR

The RF output circuit includes a one way circulator/isolator using a magnetically polarized ferrite. This device greatly reduces RF intermodulation produced when multiple transmitters are used at separations of less than five feet. It also provides additional RF output stage protection but is rarely seen in a wireless microphone transmitter due to its high cost.

CONTROLS AND FUNCTIONS



WARNING! TO PREVENT INTERNAL CORROSION!
If the transmitter is wet (either due to immersion or high levels of perspiration), BEFORE opening any covers or connectors, carefully blot the transmitter dry with a clean paper towel or cloth. Remove all moisture. After opening any connector or cover, carefully blot up any remaining moisture that may have remained around the seal. THIS IS IMPORTANT! DO NOT CLOSE ANY COVER OR CONNECTOR BEFORE MAKING CERTAIN THERE IS NO MOISTURE IN OR NEAR THE OPENING. After use, it is important to store the transmitter in a dry place with all access doors and connectors opened to allow any internal humidity to evaporate. Specifically, open the battery door, the frequency cover plate and fully unscrew and remove the microphone connector before storing. Do NOT store wet and do NOT store sealed. If moisture is sealed inside the unit it has nowhere to go other than to chemically react with and destroy components and the printed circuit board.

POWER ON/OFF SWITCH

There is no on/off switch for this unit. Insert a battery into the Battery Compartment to turn the unit on and remove the battery to turn the unit off.

Caution
There will be a thump in the associated receiver when the transmitter battery is inserted or removed. It is highly recommended to turn the receiver's audio off in the main sound prior to inserting or removing the battery from the MM400A.

POWER LED

The Power LED glows green when the battery is good. The color changes to red when there is about 30 minutes of operation left with the recommended lithium battery. (An alkaline battery will have about 20 minutes of life left.) When the LED begins to flicker red, there are only a few minutes of life.

Note
A NiMH battery will give little or no warning when it is depleted. If you wish to use NiMH batteries in the MM400A, we recommend trying fully charged batteries in the unit, noting the length of time that the batteries will run the unit and in the future use somewhat less than that time to determine when the battery needs to be replaced.

A weak battery will sometimes cause the POWER LED to glow green immediately after being put in the unit, but will soon discharge to the point where the LED will go red or shut off completely.

MIC JACK

The Microplug (2.5 mm) input on the transmitter accommodates 2 wire positive bias lavalieres. A watertight mic connector is available from Lectrosonics as an assembly

kit. (See WPMC-3 and WPMC-10 in Accessories Catalog.)

A Switchcraft 850 connector can be used in an emergency though it is not waterproof.

AUDIO LEVEL

Used to adjust the audio input level for the proper modulation.

MODULATION LEDS

The Modulation LEDs indicate the proper setting of the MIC LEVEL control. There are two bicolor modulation LEDs that can glow either red or green depending on the amount of gain applied.

"-20dB level" Glows green when the transmitter approaches 20 dB below full modulation, then shifts to red as the gain increases to 0 dB.

"-10 dB level" Glows green when the transmitter approaches 10 dB below full modulation, then shifts to red as the gain increases to +10 dB modulation.

FREQUENCY ADJUST

Two 16 position rotary Frequency Select Switches are used to select the center frequency of the carrier. The left switch is a coarse adjustment and the right switch is the fine adjustment.

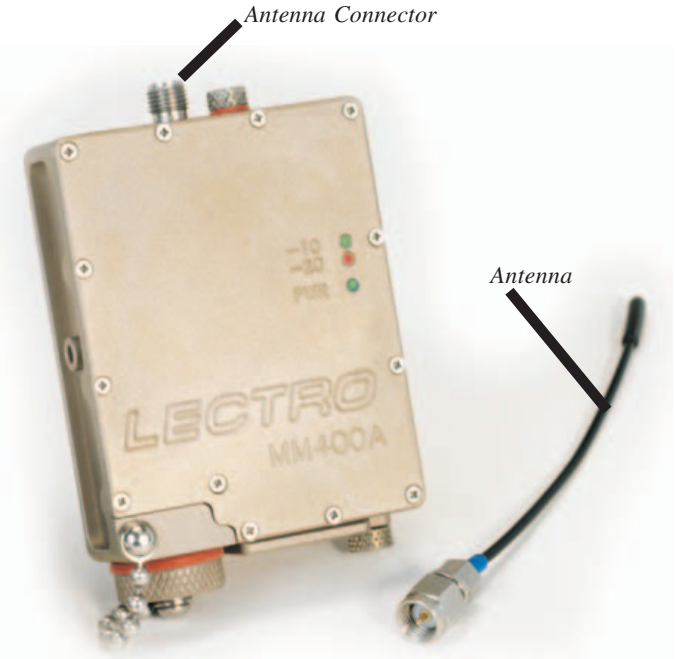
The switches are accessed by loosening the knurled knob holding the Frequency Adjust Switch Cover against the transmitter housing and rotating the cover out of the way.

Fine *Coarse*
Frequency Select Switches

ANTENNA

The flexible bronze cable antenna supplied with the transmitter is cut to 1/4 wavelength of the center of the frequency block (the frequency range) of the transmitter. It is removable via an SMA connector. The SMA connector is a 50 Ohm RF port which can also be connected directly to test equipment.

Replacement antennas are available in pre-cut lengths for specific frequency blocks, or as a kit with instructions to cut the antenna for any frequency block.



THE BELT CLIP

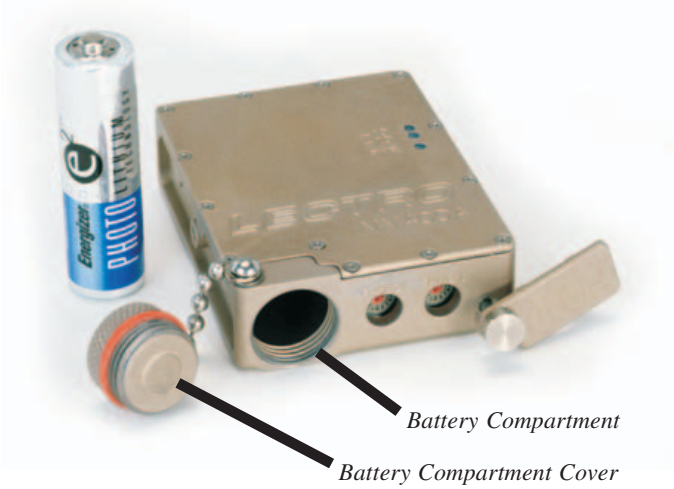
The belt clip may be removed for special applications by gently spreading the spring wire clip and pulling the ends out of the holes in the case. The clip can be installed in either the up or down position so that when the transmitter is worn, the antenna can be pointing up or down. Replacement belt clips are available as Lectrosonics part no. 26486.

BATTERY INSTALLATION

WARNING! TO PREVENT INTERNAL CORROSION!
If the transmitter is wet (either due to immersion or high levels of perspiration), BEFORE opening any covers or connectors, carefully blot the transmitter dry with a clean paper towel or cloth. Remove all moisture. After opening any connector or cover, carefully blot up any remaining moisture that may have remained around the seal. THIS IS IMPORTANT! DO NOT CLOSE ANY COVER OR CONNECTOR BEFORE MAKING CERTAIN THERE IS NO MOISTURE IN OR NEAR THE OPENING. After use, it is important to store the transmitter in a dry place with all access doors and connectors opened to allow any internal humidity to evaporate. Specifically, open the battery door, the frequency cover plate and fully unscrew and remove the microphone connector before storing. Do NOT store wet and do NOT store sealed. If moisture is sealed inside the unit it has nowhere to go other than to chemically react with and destroy components and the printed circuit board.

The transmitter is powered by a standard lithium, NiMH or alkaline AA 1.5 volt battery. Standard zinc-carbon batteries marked **"heavy-duty"** or **"long-lasting"** will not work. NiMH rechargeable batteries will only provide 2 hours of operation and will run down quite abruptly. Alkaline batteries provide over 2 hours of operation with some warning. Lithium batteries can be used to provide up to 4.5 hours. The battery status circuitry is designed for the voltage drop over the life of lithium batteries.

To open the battery compartment, unscrew and remove the battery cover. Take note of the polarity marked on the case showing the location of the positive (+) and negative (-) terminals. The positive (+) battery terminal goes into the transmitter. You can see the small contact hole inside the battery compartment with the cover removed.



Insert the battery correctly and screw the Battery Compartment Cover into the transmitter body. If the battery is inserted incorrectly, the cover will not screw in easily and the unit will not work.

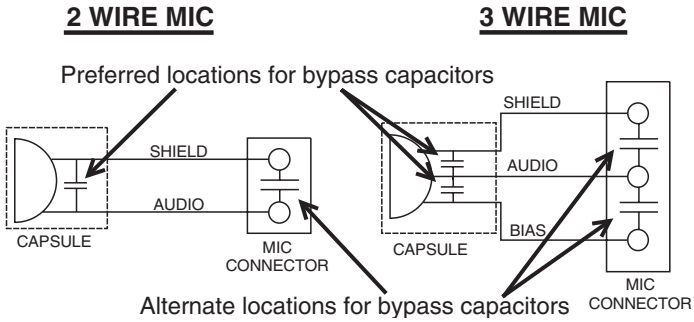
MICROPHONE RF BYPASSING

Some mics require RF protection to keep the radio signal from affecting the capsule, even though the transmitter input circuitry is already RF bypassed.

If the mic is wired as directed, and you are having difficulty with squealing, high noise, or poor frequency response; RF is likely to be the cause.

The best RF protection is accomplished by installing RF bypass capacitors at the mic capsule. If this is not possible, or if you are still having problems, capacitors can be installed on the mic wires inside the TA5F connector housing.

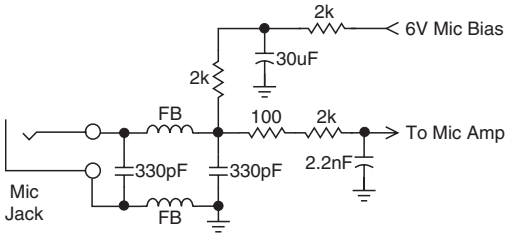
Install the capacitors as follows: Use 330 pF capacitors. Capacitors are available from Lectrosonics. Please specify the part number for the desired lead style.



Leaded capacitors: P/N 15117
Leadless capacitors: P/N SCC330P

All Lectrosonics lavalier mics are already bypassed and do not need any additional capacitors installed for proper operation.

INPUT JACK WIRING



OPERATING INSTRUCTIONS

WARNING! TO PREVENT INTERNAL CORROSION!

If the transmitter is wet (either due to immersion or high levels of perspiration), BEFORE opening any covers or connectors, carefully blot the transmitter dry with a clean paper towel or cloth. Remove all moisture. After opening any connector or cover, carefully blot up any remaining moisture that may have remained around the seal. THIS IS IMPORTANT! DO NOT CLOSE ANY COVER OR CONNECTOR BEFORE MAKING CERTAIN THERE IS NO MOISTURE IN OR NEAR THE OPENING. After use, it is important to store the transmitter in a dry place with all access doors and connectors opened to allow any internal humidity to evaporate. Specifically, open the battery door, the frequency cover plate and fully unscrew and remove the microphone connector before storing. Do NOT store wet and do NOT store sealed. If moisture is sealed inside the unit it has nowhere to go other than to chemically react with and destroy components and the printed circuit board.

SELECTING THE COMPATIBLITY MODE

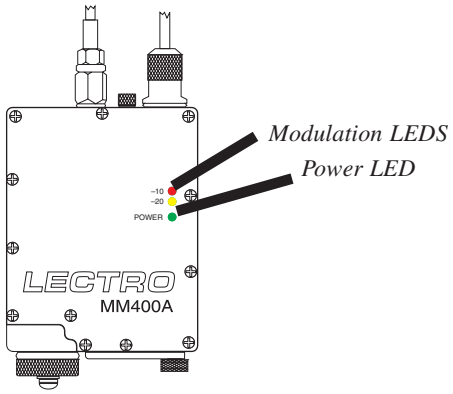
All Digital Hybrid units are capable of working with Lectrosonics MM400A transmitter, and by setting the proper compatibility mode, the unit will also work with 200 Series and 100 Series analog receivers, plus some other analog wireless receivers (contact the factory for details). The transmitter must be set to the operating mode of the matching receiver, which is easily done using a small screwdriver and a battery.

NOTE
The unit comes from the factory as a 400 series transmitter

1) Set the audio controls for the corresponding receiver to off.

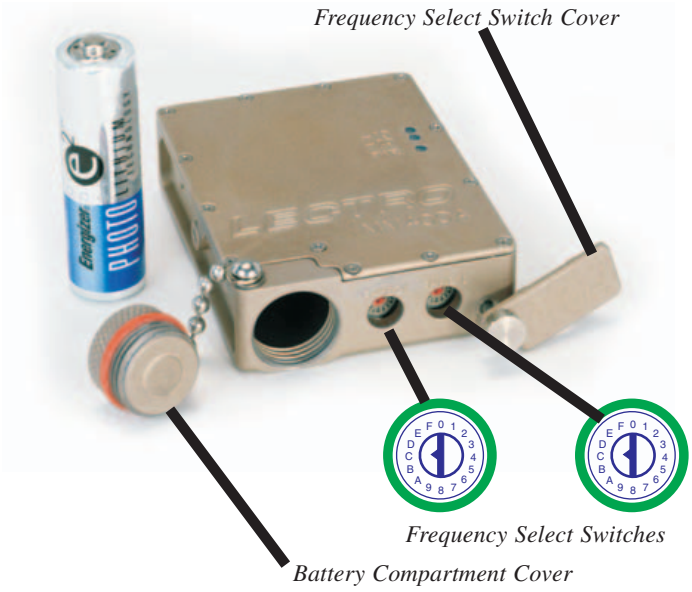
2) Install a good battery and verify the Power LED glows green. Also verify the current Compatibility Mode by observing the Modulation LEDs. The –20 and –10 LEDs will blink simultaneously:

- Once for 100 Series mode
- Two times for 200 Series mode
- Three times for “Other” receivers
- Four times for 400 Series mode



3) Remove the battery.

4) Open the Frequency Select Switch cover and with a small screwdriver (included with your unit), set the Fequency Select Switches to CC. (for **C**hange, **C**hange).



5) Install the battery to power up the unit briefly – just a couple of seconds (just watch for the LED’s to light up) and then remove the battery.

6) Change the Frequency Select Switch settings to one of the following positions:

• 100 Series mode:	1,1
• 200 Series mode:	2,2
• Mode 3 (Contact dealer for details):	3,3
• 400 Series mode:	4,4

7) Install the battery, as soon as the Power LED and Modulation LEDs glow, remove the battery.

8) Set the Frequency Select switches to 0,0.

9) Turn on the transmitter top verify the compatiblity mode for the unit has changed.

Note
Each time the transmitter is turned on, it will confirm the current operating mode

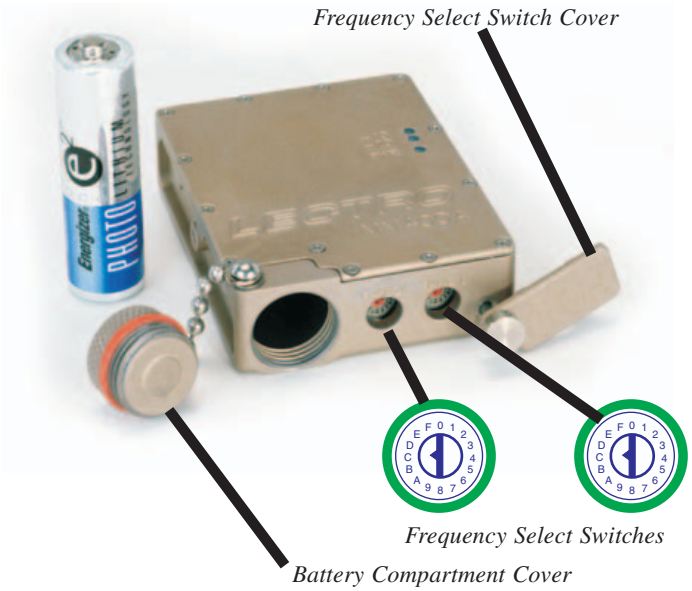
with the number of blinks listed in Step 1. The mode setting will remain the same until you reset it with the procedure listed above.

ADJUSTING THE TRANSMITTER FREQUENCY

If you are experiencing interference from another signal on your frequency, you may want to change the operating frequency of your system. The left switch (COARSE) changes the operating frequency by large increments and the right switch (FINE) changes it in small increments. If you are experiencing interference, change the operating frequency in fine steps to find a clear channel.

If it is not possible to find a clear channel using the Fine switch, return it to its original position and change the Coarse switch by one click then try the Fine switch again. Lectrosonics 400 series receivers have a built-in frequency scanner which makes finding a clear channel very easy. See the separate receiver manual for instructions.

To gain access to these switches, unscrew the retaining bolt that holds the access door to the case. It is not necessary to remove the bolt from the case since it is retained by the case with enough room to still remove the access door. Pull the access door away from the case and swing the door to the side to gain access to the frequency switches.

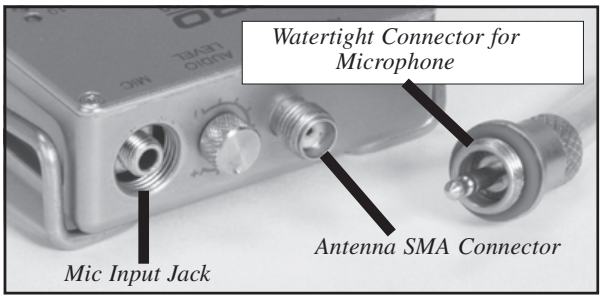


ATTACHING A MICROPHONE AND ADJUSTING GAIN

The front panel Modulation LEDs indicate limiter activity. At -20 dB, the -20 LED glows green. At -10 dB, both the -20 and the -10 LEDs glow green. At 0 dB, the -20 LED glows red and the -10 LED glows green, and at +10 dB, both LEDs glow red. Since the distortion introduced by the limiter is minimal and full modulation is assured, occasional forays into the red by the -10 LED is acceptable.

Generally speaking, some limiting is acceptable in normal operation to improve the signal to noise ratio of the system. The limiting action is not audible and does not create distortion. A highly trained ear would hear only the compression of the peaks in the audio signal, which is desirable with most recorders and many sound reinforcement systems.

1) Insert the watertight microphone plug into the Micorphone Input Jack and screw it in snuggly.

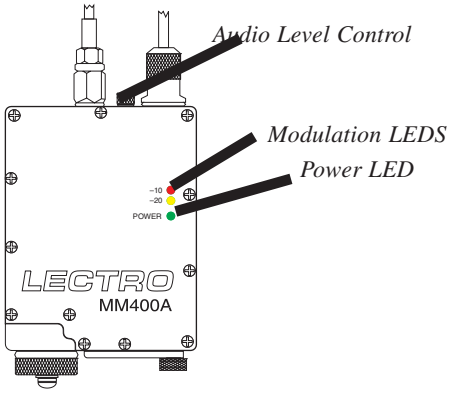


3) Mute the main sound system and rotate the Audio Level Control on the MM400A to maximum counterclockwise (Off).

4) Insert the battery to turn on the transmitter

5) Position the microphone in the location where it will be used in actual operation.

6) Observe the MM400A Modulation LEDS while speaking or singing at the same voice level that will be used during the program. Gradually rotate the AUDIO LEVEL control clockwise until the -20 LED glows red and the -10 dB glows green with occassional red flickers. This flikcer indicates full modulation and is the optimum setting for the transmitter's gain.



7) Once the MM400's audio gain has been set, the remaining components of the audio system can be energized and adjusted.

OPERATING NOTES

The AUDIO LEVEL control should not be used to control the volume of your sound system or recorder levels. This gain adjustment matches the transmitter gain with the user's voice level and microphone positioning.

If the audio level is too high — both red LEDs will light frequently or stay lit. This condition may reduce the dynamic range of the audio signal.

If the audio level is too low — neither LED will light, or the -20 LED will light green. This condition may cause hiss and noise in the audio.

Different voices will usually require different settings of the AUDIO LEVEL control, so check this adjustment as each new person uses the system. If several different people will be using the transmitter and there is not time to make the adjustment for each individual, adjust it for the loudest voice.

REPLACEMENT PARTS AND ACCESSORIES

Item	Model/Part Number
Replacement wire belt clip	Lectrosonics #26486
Replacment whip antenna	Lectrosonics AMM (xx) - specify frequency block (xx)
Non-watertight audio input plug	Lectrosonics #21357, Switchcraft 850 microplug
Watertight plug kit - 3 pieces	WPMC-3
Watertight plug kit - 10 pieces	WPMC-10

TROUBLESHOOTING

Before going through the following chart, be sure that you have a good battery in the transmitter. It is important that you follow these steps in the sequence listed.

SYMPTOM	POSSIBLE CAUSE
TRANSMITTER BATTERY LED OFF	1) Battery is inserted backwards. 2) Battery is dead.
NO TRANSMITTER MODULATION LEDs	1) Gain control turned all the way down. 2) Battery is in backwards. Check power LED. 3) Mic capsule is damaged or malfunctioning. 4) Mic cable damaged or mis-wired.
RECEIVER RF LAMP OFF	1) Transmitter not turned on. 2) Transmitter battery is dead. 3) Receiver antenna missing or improperly positioned. 4) Transmitter and receiver not on same frequency. Check switches/display on transmitter and receiver. 5) Operating range is too great. 6) Transmitter antenna not connected
NO SOUND (OR LOW SOUND LEVEL), RECEIVER INDICATES PROPER AUDIO MODULATION	1) Receiver output level set too low. 2) Receiver output is disconnected; cable is defective or mis-wired. 3) Sound system or recorder input is turned down. 4) Receiver/Transmitter compatibility mode mismatched.
DISTORTED SOUND	1) Transmitter gain (audio level) is far too high. Check mod level lamps on transmitter and receiver as it is being used. (refer to pages 8/9 for details on gain adjustment) 2) Receiver output may be mis-matched with the sound system or recorder input. Adjust output level on receiver to the correct level for the recorder, mixer or sound system. 3) Excessive wind noise or breath “pops.” Reposition microphone and/or use a larger windscreen. 4) Transmitter is not set to same frequency as receiver. Check that frequency select switches on receiver and transmitter match. 5) Receiver/Transmitter compatibility mode mismatched.
HISS AND NOISE -- AUDIBLE DROPOUTS	1) Transmitter gain (audio level) far too low. 2) Receiver antenna missing or obstructed. 3) Transmitter antenna missing. 4) Operating range too great.
EXCESSIVE FEEDBACK	1) Transmitter gain (audio level) too high. Check gain adjustment and/or reduce receiver output level. 2) Transmitter too close to speaker system. 3) Mic is too far from user’s mouth.

SPECIFICATIONS AND FEATURES

Operating frequencies:
Block 21 537.600 - 563.100
Block 22 563.200 - 588.700
Block 23 588.800 - 607.900 and 614.100 - 614.300
Block 24 614.400 - 639.900
Block 25 640.000 - 665.500
Block 26 665.600 - 691.100
Block 27 691.200 - 716.700
Block 28 716.800 - 742.300
Block 29 742.400 - 767.900

Frequency selection: 256 frequencies in 100 kHz steps

RF Power output: 100 mW (nominal)

Pilot tone: 25 to 32 kHz; 5 kHz deviation (in 400 Series Mode)

Frequency stability: ± 0.002%

Deviation: ± 75 kHz max. (in 400 Series Mode)

Spurious radiation: 60 dB below carrier

Equivalent input noise: –118 dBV, A-weighted

Input level: Nominal 2 mV to 300 mV, before limiting.
Greater than 1.5V maximum, with limiting.

Input impedance: 2 kOhm

Input limiter: Soft limiter, >30 dB range

Gain control range: 43 dB; semi-log rotary control

Modulation indicators: Dual bicolor LEDs indicate modulation of –20, -10, 0, +10 dB referenced to full modulation.

Low frequency roll-off: –12 dB/octave; 70 Hz

Controls: Front panel knob adjusts audio gain.
Rotary switches on bottom panel adjust transmitter frequency.

Audio Frequency Response: 70 Hz to 20 kHz, +/-1dB *(The audio is deliberately rolled off at 70 Hz using a 12 dB/octave filter. This filter cannot be disabled.)*

Signal to Noise Ratio (dB): (overall system, 400 Series mode)

SmartNR	No Limiting	W/ Limiting
OFF	103.5	108.5
NORMAL	107.0	111.5
FULL	108.5	113.0

(Note: The dual envelope "soft" limiter provides exceptionally good handling of transients using variable attack and release time constants. The gradual onset of limiting in the design begins below full modulation, which reduces the measured figure for *SNR without limiting* by 4.5 dB)

Total Harmonic Distortion: 0.2% typical (400 Series mode)

Audio Input Jack: 2.5 mm Microjack (matches Switchcraft 850 Microplug)

Antenna: Detachable, flexible bronze wire supplied. 50 Ohm port allows connection to test equipment.

Battery: 1.5 Volt AA lithium recommended

Battery Life: 2 hours (alkaline); 4.5 hours (lithium); NiMH: 3.5 hours

Weight: 3.6 ozs. (102 grams) with lithium battery, no antenna

Overall Dimensions: 3.03 x 2 x 0.69 inches (not including microphone or antenna)

Emission Designator: *180KF3E*

Specifications subject to change without notice.

The FCC requires that the following statement be included in this manual:

This device complies with FCC radiation exposure limits as set forth for an uncontrolled environment. This device should be installed and operated so that its antenna(s) are not co-located or operating in conjunction with any other antenna or transmitter.

SERVICE AND REPAIR

If your system malfunctions, you should attempt to correct or isolate the trouble before concluding that the equipment needs repair. Make sure you have followed the setup procedure and operating instructions. Check out the interconnecting cords and then go through the TROUBLESHOOTING section in the manual

We strongly recommend that you **do not** try to repair the equipment yourself and **do not** have the local repair shop attempt anything other than the simplest repair. If the repair is more complicated than a broken wire or loose connection, send the unit to the factory for repair and service. Don't attempt to adjust any controls inside the units. Once set at the factory, the various controls and trimmers do not drift with age or vibration and never require readjustment. **There are no adjustments inside that will make a malfunctioning unit start working**.

LECTROSONICS service department is equipped and staffed to quickly repair your equipment. In-warranty repairs are made at no charge in accordance with the terms of the warranty. Out-of-warranty repairs are charged at a modest flat rate plus parts and shipping. Since it takes almost as much time and effort to determine what is wrong as it does to make the repair, there is a charge for an exact quotation. We will be happy to quote approximate charges by phone for out-of-warranty repairs.

RETURNING UNITS FOR REPAIR

You will save yourself time and trouble if you will follow the steps below:

A. DO NOT return equipment to the factory for repair without first contacting us by letter or by phone. We need to know the nature of the problem, the model number and the serial number of the equipment. We also need a phone number where you can be reached 8 am to 4 pm (Mountain Standard Time).

B. After receiving your request, we will issue you a return authorization number (R.A.). This number will help speed your repair through our receiving and repair departments. The return authorization number must be clearly shown on the outside of the shipping container.

C. Pack the equipment carefully and ship to us, shipping costs prepaid. If necessary, we can provide you with the proper packing materials. UPS is usually the best way to ship the units. Heavy units should be "double-boxed" for safe transport.

D. We also strongly recommend that you insure the equipment, since we cannot be responsible for loss of or damage to equipment that you ship. Of course, we insure the equipment when we ship it back to you.

Mailing address:
Lectrosonics, Inc.
PO Box 15900
Rio Rancho, NM 87174
USA

Shipping address:
Lectrosonics, Inc.
581 Laser Rd.
Rio Rancho, NM 87124
USA

Telephones:
Regular: (505) 892-4501
Toll Free (800) 821-1121
FAX: (505) 892-6243

World Wide Web: *http://www.lectrosonics.com* ***Email:*** *sales@lectrosonics.com*

LIMITED ONE YEAR WARRANTY

The equipment is warranted for one year from date of purchase against defects in materials or workmanship provided it was purchased from an authorized dealer. This warranty does not cover equipment which has been abused or damaged by careless handling or shipping. This warranty does not apply to used or demonstrator equipment.

Should any defect develop, Lectrosonics, Inc. will, at our option, repair or replace any defective parts without charge for either parts or labor. If Lectrosonics, Inc. cannot correct the defect in your equipment, it will be replaced at no charge with a similar new item. Lectrosonics, Inc. will pay for the cost of returning your equipment to you.

This warranty applies only to items returned to Lectrosonics, Inc. or an authorized dealer, shipping costs prepaid, within one year from the date of purchase.

This Limited Warranty is governed by the laws of the State of New Mexico. It states the entire liablility of Lectrosonics Inc. and the entire remedy of the purchaser for any breach of warranty as outlined above. NEITHER LECTROSONICS, INC. NOR ANYONE INVOLVED IN THE PRODUCTION OR DELIVERY OF THE EQUIPMENT SHALL BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, CONSEQUENTIAL, OR INCIDENTAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THIS EQUIPMENT EVEN IF LECTROSONICS, INC. HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL THE LIABILITY OF LECTROSONICS, INC. EXCEED THE PURCHASE PRICE OF ANY DEFECTIVE EQUIPMENT.

This warranty gives you specific legal rights. You may have additional legal rights which vary from state to state.

LECTROSONICS, INC.
581 LASER ROAD
RIO RANCHO, NM 87124 USA
www.lectrosonics.com

May 15, 2004